

Serial No.: 10/608,883

Group Art Unit: 2813

REMARKS

Specification

The disclosure is objected to because the Cross-Reference section needs to be updated to indicate that U.S. Appl. Ser. No. 10/226,520 has issued as US Pat. No. 6,642,145 B1.

Applicants have updated this section as required.

Claim Objections

Claims 11, 15 are objected to because of informalities in claims 11 and 15 pertaining to grammar.

With regard to claim 11, line 4, "a opening" has been amended to --an opening--.

With regard to claim 15, line 4, "a opening" has been amended to --an opening--.

Claim Rejections - 35 USC §102

Claims 11-14 are rejected under 35 U.S.C. 102(e) as being anticipated by Passemard (US 2001/0004550 A1, hereinafter "Passemard").

With regard to claims 11-14, Applicants respectfully traverse the rejections since the Applicants' claimed combination, as exemplified by claim 11, includes the limitation not disclosed in Passemard of:

"a dielectric layer of non-barrier dielectric material capable of being changed into a barrier dielectric material and having a opening provided therein, the dielectric layer around the opening of the barrier dielectric material;" [underlining for clarity]

The Examiner states in the Office Action:

- “• The interconnection structure includes a sublayer of SiCH (11 in Fig. 3) and a sublayer of SiOCH (12 in Fig. 3);
- Both sublayers (11, 12) have openings formed through them that are subsequently filled with copper (9);”

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In Passemard, as stated by the Examiner above, there are two separate sublayers of SiCH and SiCOH, each with an opening.

It is respectfully submitted that Passemard does not disclose a dielectric layer of a non-barrier dielectric material (SiCOH) with a barrier dielectric material (SiC(H)) around the opening as claimed. As shown in FIG. 3 and explained in Specification page 7, lines 9-11, a SiCOH dielectric layer has SiC(H) around an opening:

"Around the first channel 202 is a region of barrier polymeric silicon carbide (SiC(H)) material 225, which is known to have good diffusion barrier properties, in the non-barrier SiCOH material [208]."

Based on the above, it is respectfully submitted that claims 11-14 are allowable under 35 USC §102(e) as not being anticipated by Passemard because:

"Anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, *arranged as in the claim.*" [emphasis added] Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co. (730 F.2d 1452, 221 USPQ 481, 485 (Fed. Cir. 1984)(citing Connell v. Sears, Roebuck & Co., 722 F.2d 1542, 220 USPQ 193 (Fed. Cir. 1983))).

Withdrawal of the rejections is respectfully requested.

Claim Rejections - 35 USC §103

Claims 15-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Passemard (US 2001/0004550 A1, hereinafter "Passemard") in view of Ito (US 6,372,114, hereinafter "Ito").

With regard to claims 15-18, Applicants respectfully traverse the rejections since the Applicants' claimed combination, as exemplified by claim 15, includes the limitation not disclosed in Passemard of:

"a dielectric layer of non-barrier dielectric material capable of being reduced into a barrier dielectric material and having an opening provided therein, the dielectric layer around the opening of the barrier dielectric material;" [underlining for clarity]

The Examiner states in the Office Action:

"• The interconnection structure includes a sublayer of SiCH (11 in Fig. 3) and a sublayer of SiOCH (12 in Fig. 3);

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- Both sublayers (11, 12) have openings formed through them that are subsequently filled with copper (9);”

In Passemard, as stated by the Examiner above, there are two separate sublayers of SiCH and SiCOH, each with an opening.

It is respectfully submitted that Passemard does not teach or suggest a dielectric layer of a non-barrier dielectric material (SiCOH) with a barrier dielectric material (SiC(H)) around the opening as claimed. As shown in FIG. 3 and explained in Specification page 7, lines 9-11, *supra*, the invention teaches that a SiCOH dielectric layer has SiC(H) around an opening.

Based on the above, claims 15-18 are allowable under 35 U.S.C. 103(a) as being unobvious over a combination with Passemard because Passemard does not teach or suggest the limitation set forth by the Examiner and because:

“[T]he prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant’s disclosure.” *In re Vaack*, 947 F2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991)

The Examiner continues in the Office Action:

“However, Passemard lacks a seed layer that lines the opening, which is a limitation set forth in claim 15 of the applicant’s invention.

Ito teaches the use of a copper seed layer (109 in Fig. IC) to line openings formed in an insulator (105 in Fig. IC) for the subsequent plating of a copper layer (110 in Fig. ID) to fill the openings (also see column 5, lines 9-43).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine the teachings of Passemard and Ito in order to fill the openings of Passemard with copper by using a plating process that includes a copper seed layer as taught by Ito. Copper plating is one known way to deposit copper and Ito recognizes that a seed layer is needed as an electrode for such plating processes (see column 5, lines 30-31).”

Applicants respectfully disagree.

Taken as a whole, Passemard teaches that a seed layer is not required as shown in FIG. 10 and taught in para. [0031]:

“A titanium nitride or tantalum nitride layer 8...also adheres to the walls and bottom of the hole 7, which is then filled with copper.” [deletion for clarity]

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Taken as a whole, Ito teaches that a second barrier metal layer deposited by sputtering should have a sputtered copper seed layer in col. 5, lines 20-28:

"With reference to FIG. 1C, a second barrier metal layer 108 of titanium nitride is entirely deposited by a sputtering method... A copper seed layer 109 is then deposited on the second barrier metal layer 108 by a sputtering method." [deletion for clarity]

Since neither reference, taken as a whole, teaches or suggests the combination and appears to teach away from the combination, it is respectfully submitted that claims 15-18 are allowable under 35 U.S.C. 103(a) as being unobvious over Passemard in view of Ito because it is required that the subject matter be obvious as a whole:

"A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made."

In addition, Passemard teaches that a seed layer is not required, and Ito teaches that a seed layer is required. Neither reference teaches or suggests the combination. It is respectfully submitted that claims 15-18 are allowable under 35 U.S.C. 103(a) as being unobvious over Passemard in view of Ito because the CAFC has held In *In re Sang-Su Lee*, 277 F.3d 1338, 61 USPQ2d 1430 (Fed. Cir. 2002), that the conclusion of obviousness may not be made from common knowledge and common sense of a person of ordinary skill in the art without any specific hint or suggestion in a particular reference.

The other references cited by the Examiner showing the prior art have been considered and are not believed to disclose, teach, or suggest, either singularly or in combination, Applicants' invention as claimed.

Conclusion

In view of the above, it is submitted that the claims are in condition for allowance and reconsideration of the rejections is respectfully requested. Allowance of claims 11-18 at an early date is solicited.

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To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including any extension of time fees, to Deposit Account No. 01-0365 and please credit any excess fees to such deposit account.

Respectfully submitted,



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Date: August 27, 2004